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NOTE ON IRRIGATION
IN THE
DHOLPUR STATE
1905.

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NOTE BY THE CONSULTING ENGINEER FOR IRRIGATION ON THE RIVER PARBATI IN THE DHOLPUR STATE.

On the 15th March 1905 the Consulting Engineer (Colonel Sir S. Jacob) went to Khanpur with the State Engineer (Mr. A. N. Thorpe). The next morning they visited Scheri, where a large storage tank, now called "Ram Sagar," after the present Maharaj Rana of Dholpur, is being carried out.

This is one of the large storage tanks suggested in November 1902. It is satisfactory to see the progress which has been made, and the excellent way in which the work is being carried out under Mr. Thorpe's supervision.

It is important that the escape should be on rock. To ensure this it is suggested that the bund be extended at the west end. The advantages obtained in the extra water which would be stored, and the less fear of any land being cut up by the overflow, are well worth the small extra cost.

2. From here they went *via* Oonree to Dhinri, about 7 miles west to north-west of Barai, and in the evening inspected the Parbati River and the site of a proposed storage reservoir on the river just above Barai.

The next day they rode up the river, inspecting sites on the river at Kuragaon and Khurdia, and encamped at Khannot. In the evening they went still higher up the river as far as Mandasil.

3. The following Note by Mr. Thorpe, on Irrigation from the River Parbati, dated 20th March 1905, will explain his ideas:—

Preliminary Report on the "Parbati River" Irrigation Project.

"1. The catchment of the Parbati River, where it leaves the hills near Thamoti-Mohari, is 340 square miles, which, assuming the rainfall at 24 inches, and the "run-off" at 30 per cent., would give some 5,700 million cubic feet of water as available for storage.

"2. The survey of a dam at this site was carried out during the season 1903-04, which proved that a dam with the weir crest 70 feet above the river bed would give a storage capacity of 5,000 m. c. ft., but an examination of the river bed for foundations showed that it was composed of a most unreliable shale, which could be traced to a depth of 18 feet without any change in its character. Another objection against a dam at this point was that this highly cultivated village of Barai would be permanently submerged and an ancient temple destroyed.

"3. These considerations led to the abandonment of the site and a systematic examination of the upper reaches of the river with a view to obtaining sounder sites; and if no sufficiently large basin could be found, the selection of several smaller ones to impound the whole of the available water. One consideration had, however, to be kept in view, namely—that the best land for irrigation lay on the large plain to the north of the river, and to the east of Baseri, and that, wherever the storage might be situated the canal alignment should eventually command this plain.

"4. The examination of the upper reaches of the river showed that the river bed consisted of a number of "giant steps," level reaches, of ten miles long, being succeeded by sharp short falls.

"5. The Parbati River, rising in the Karanli State, enters Dholpur through a deep gorge near Bilonic, from whence to Chandpur the river continues to rush down its rocky bed at great velocity, owing to the steep grade of its bed. At Chandpur the first of the "steps" occurs, followed by a short reach and a further drop of 8 feet. At Baragaon another drop of 10 feet occurs, followed by a level stretch of 3 miles, until the Mandasil Falls are reached. At this point a sheer drop of 15 feet is followed by a further fall of 25 feet in half a mile. Another level stretch of one and a half miles ends at Khurdia, where a rapid of half a mile lowers the river bed another 23 feet. The succeeding reach of 6 miles brings us to Liloti, where a drop of 15 feet in 300 yards is followed by a one mile reach, ending with the great rock barrier at Kuraganon, where with a leap of 35 feet in a mile, the river enters a maze of ravines some eight miles long, ending at Banora, with a gently-falling bed from there to Barai, where a drop of 3 feet in 100 yards occurs. From Barai to Thainoti the level is maintained, but below the last-named the river bounds out from the hills at immense velocity, down a steep rock with a slope of 40 feet to the mile, the total drop being some 60 feet.

"6. During its course through the hills the river is joined by two large tributaries, one on each bank. From the south the Kharrai Nadi leaves the very rugged hills near Donai, and proceeds on a fairly level bed through highly-cultivated country to Sirnittra, where a fall of 30 feet in one mile brings it to the river bed level a short distance above Khurdia.

"7. From the north the Saini River enters from Karanli through the natural basin of Mahar, and continues on the level to Bareunjara, whence a fall of 40 feet in three miles discharges it into the Parbati near, but slightly below, Kuraganon.

"8. From an irrigation point of view the most favourable sites for storage tanks must necessarily be immediately above one of the falls, which, composed as they are of rock barriers, secure that most necessary consideration, a good foundation for a dam. In addition to this these points must obviously give the longest stretch of level bed, and therefore the greatest storage capacity, and lastly, being immediately above a fall, the greatest command of the irrigable area below.

"9. The above considerations therefore confine the choice of sites to five, viz :—

	Catchment Area. Square Miles.	Rainfall in Inches.	Water available for Storage. Million Cubic Feet.
(a) Mandasil	196·24*	24	1,773
(b) Khurdia	140·74*	24	2,358
(c) Kuragaon	196·10*	24	3,271
(d) Barai	240·60*	24	4,030
NORTH BRANCH			
(e) Mahar	89·66	23	1,560

* Excluding the C.A. of Mahar.

"Site (a) Mandasil was rejected on account of the highly-cultivated state of the country, and the small basin which a casual inspection showed could not hold the available "run-off" without an unduly high dam.

"Site (b) Khurdia has been surveyed and found a fairly favourable site where a dam 61 feet high to weir crest would store the required quantity of water. The objections to this site are, the very sandy bed, the broken ground on the south bank through which the irrigation canal must necessarily lead, and the cross drainage which the canal must encounter. The broken ground extends some 1,000 yards, after which a large level plain is encountered. A small amount of cultivation in Khurdia village will be permanently submerged, but as the total rental of that village is only Rs. 2,000 per annum this is a minor consideration. Some good land in Mandasil village will be temporarily submerged.

"Site (c) Kuragaon was rejected on account of the sand-hills unduly confining the basin, and the absence of irrigable land below.

"Site (d) Barai, although not an ideal site, is a good one, with fairly good foundations across the river bed. It is extremely favourable for the canal line, which would take off from the north bank and command the whole of the Baseri Plain. With a weir crest of 47 feet above river bed level it would have a capacity of 2,374 m.c.ft. With a dam 71 feet high at weir crest the capacity would be 11,220 m.c.ft, which for a sand dam would appear somewhat hazardous.

"Site (e) Mahar has been surveyed, and with a weir crest 43 feet above river level would contain 2,269 m.c.ft. The basin is an ideal one, but some valuable land would be submerged, and the irrigable area below is somewhat limited.

"10. Taking all considerations into account it would appear that the best Project for utilising the vast quantity of water now flowing away unused to the sea would be that in which three large storage tanks are involved; the two high level ones irrigating all available land within a reasonable distance and discharging their surplus water down the river bed into the lower tank, which should command the vast Baseri Plain.

"11. Pending the completion of the detailed estimates and the comparison of cost, the following would appear to be the most favourable sites for a Project of this class, *viz* :—

			Catchment Area Square Miles.	Storage Capacity. Million Cubic Feet.
(1)	Khurdia	...	140.74	2,358
(2)	Mahar	...	89.66	2,269
(3)	Baria	...	330.26	2,374
		...	230.40	
			99.86	
	Combined	...	330.26	7,001

In this Project Nos. 1 and 2 would discharge their surplus waters into No 3, and the whole Project would have an irrigation capacity of 70,000 acres."

4. The upper parts of the River Parbati, as Mr. Thorpe states, consist of level reaches, succeeded by rocky falls; the most favourable sites for dealing with the river are naturally just above each of these falls, because at such places :—

- (1) There is a greater command of the country below.
- (2) There is no difficulty about foundations.
- (3) There is plenty of material at hand from the rock close by.
- (4) There is the best storage capacity from the long level stretch of river bed, above the fall.

5. There are five such sites on the River Parbati at—

- (1) Mandasil.
- (2) Khurdia.
- (3) Kuragaon.
- (4) Barai.
- (5) Thamoti.

And one on the north branch at Mahar.

Regarding—

(1) *Mandasil*.—I agree with Mr. Thorpe for rejecting this, for the reasons he states.

Regarding—

(2) *Khurdia*.—The objections to this site are the sandy nature of the proposed reservoir bed; the broken ground and cross drainage on the south bank through which the canal would have to pass; the rocky range which somewhat confines the basin and the scope of any canal on the left bank for some distance.

At the same time the site has advantages. There is good rock for the foundations in the bed of the river; there is a good site for the escape on the left bank on rock at the north end; there is any amount of good material—rock, sand and kunkar near for making the dam; a great

portion of the bund on the right bank could be made of sand ; there would be little land of any value submerged ; a great part of the catchment area is rock, and any reservoir would quickly fill every year ; the high level at which the water would be stored ought to enable it to command a large area.

The sand in the bed of the proposed reservoir may cause some silting up, but would not, I think, give much trouble, for it would take many years to silt up the river bed to its banks, and the bed could be cultivated as the water receded.

If any storage reservoir is made here, it will be advisable to provide large sluices for scouring in case of need, and also to allow water to flow freely down the river to fill any other reservoirs which may be made hereafter. This is important.

The canal line was not marked out, but I understand the country has been levelled and the general line has been fixed.

Regarding—

(3) *Kuruyaon*.—Mr. Thorpe states : “This was rejected on account of the sand-hills unduly enclosing the basin, and the absence of irrigable land below.”

There is such a good crossing of the river here on solid rock, “a great rock barrier with a leap of 35 feet in a mile,” and such a profusion of rock lying about, that it seems to be an ideal place for a masonry dam or weir, as far as the site is concerned.

No work or expense would be required on the left bank ; there is a natural bund of rock on this side, and it seemed that an earthen bund might be made on the right bank, across to Bhaonpura, or the high ground in this direction, and if this is feasible, there would apparently be a good storage basin.

At the same time it is quite possible the levels will not admit of this ; or too much cultivated land may be submerged ; or, as Mr. Thorpe thinks, it might be impossible to reach irrigable land below. It is true there is any amount of good land eastward on the Baseri plain ; to reach this, however, it would be necessary to cross the Sairni nullah ; to reach good land on the right bank would also present great difficulties ; any canal on either bank would have to cross a great deal of broken ground, and may prove too costly, even if possible.

The site, however, appears such a good one that it is suggested levels be taken, and if found to be at all feasible, proper plans and estimates be prepared.

Regarding—

(4) *Barai*.—The basin is large, there is rock visible in the river bed, and Mr. Thorpe states rock is found right across, and that an escape on rock can be made somewhere at the east end.

There would be less difficulty, it is true, in taking a canal off from here than at other sites ; and a canal would command a great part of the Baseri plain.

It is not, however, an ideal site, and the plans and estimates do not appear to be fully prepared. Without knowing more and comparing the plans and estimates with alternative Projects I do not feel justified in giving a decided opinion on this scheme.

Regarding—

(5) *Thamoti*.—It will be remembered, perhaps, that a Project was proposed by the State Engineer (Mr. Thorpe) in November 1902 for making a large storage reservoir on this River Parbati, at a place called Thamoti—Mohari (Site No. 5), about 2 miles lower down than Site No. 4. No plans and estimate had been prepared, but the Consulting Engineer, while then approving of this site, suggested that before any decision was formed, it would be advisable to examine the course of the river from its source to see if any better sites exist higher up; and if so, if it would be possible to make use of the water which could be stored.

Mr. Thorpe now reports that an examination of the river bed here for foundations showed that it was composed of a most unreliable shale, which could be traced to a depth of 18 feet without any change in character, and that the highly-cultivated village of Barai would be permanently submerged, and an old temple destroyed, and for these reasons this site was abandoned.

Regarding—

(6) *Mahar*.—Mr. Thorpe states that the project has been surveyed, and that a weir with a crest 43 feet above river level would contain 2,269 million cubic feet, but some valuable land would be submerged, and that the irrigable area below is somewhat limited; the quantity in either case is not stated. The remarks made by the Consulting Engineer, therefore, in December 1902 on this Project still hold good. It is unnecessary to repeat them here.

6. The above remarks show how the matter now stands. The River Parbati is the main artery, as it were, of the Dholpur State, and in the interests of the State the water of this river should *all* be stored, if it is possible to store it. It rises in the highest part of the State; it has a fine catchment of a range of hills of sand-stone rock, which ensure a good flow-off; it has ledges of rock in places where any amount of good material is available for making dams; above its natural falls it has a good command of the country; there is any amount of good land below (the whole State of Dholpur in fact) to be irrigated, almost every drop of water could be utilised, and all now goes to waste.

It would be difficult to find conditions more favourable for Irrigation.

The real difficulty is how to make the best use of these great natural advantages.

7. The two ways of dealing with the river appear to be :—

- (1) To make storage reservoirs on the river, or its tributaries ; or,
- (2) By permanent weirs on the river, above some of the falls, to divert the water to where it can be stored elsewhere, and used as required.

Although no places for doing (2) have been pointed out, yet it is well to bear the possibility in mind. During the months that irrigation is not required and water is flowing in the river the canals might be used, perhaps, to convey any surplus water to storage tanks elsewhere, if suitable places exist.

Large storage tanks have many advantages over small tanks ; storage reservoirs, therefore, should be as large as circumstances permit. The higher up these storage tanks can be made, as a general rule, the greater command they will have, and being on the same river the higher ones can be made to supplement those below.

8. Not a drop of water should be allowed to go to waste. This is the great principle which should be kept steadily in view. There is no need to be in a hurry. There are other good Projects which can be taken up. In the meantime too much trouble cannot be taken to thrash out alternative Projects and compare results.

9. The catchment of the River Parbati near Thamoti is about 340 square miles, and assuming the run-off as 30 per cent. of an average annual rainfall of 24 inches, about 6,000 million cubic feet of water is available for storage, sufficient to irrigate about 60,000 acres, and every year this is passing away unused.

10. It is better not to attempt the storage of this in one place, but to distribute it over three or four places, and although it is easy to fix upon the most likely places (as Mr. Thorpe has done) it is difficult to say which is the best to take up first, until each Project has been properly prepared and it is possible to compare one with the other. Other things being equal the higher up the better, and as good land gives a better return than land of an inferior quality, the Project which would command the best land should be preferred.

11. In the meantime further investigation is advisable ; the plans and estimates of alternative Projects should be carefully prepared ; the land which can be irrigated from each should be marked out ; the anticipated returns from each Project should be carefully estimated, the results compared and the opinion of the Revenue Officials invited.

12. It is clear the River Parbati might be made a source of great benefit to the State ; at present it is entirely unused ; and the best way of storing all this water I consider to be the greatest and most important work that the State can undertake.

S. S. JACOB, Col.,
Consulting Engineer for Irrigation.